

58.

$$\frac{dy}{dt} = k \frac{A}{V} (c - y)$$

$$a) y = c - (c - y_0) e^{-k \frac{A}{V} t}$$

$$b) = c \quad y < c$$

$$\int \frac{dy}{c-y} = \int k \frac{A}{V} dt$$

$$-\ln(c-y) = k \frac{A}{V} t + c_1$$

$$e^{\ln(c-y)} = e^{(-k \frac{A}{V} t + c_1)}$$

$$c-y = e^{-k \frac{A}{V} t} \cdot e^{c_1} = G e^{-k \frac{A}{V} t}$$

$$y = c - G e^{-k \frac{A}{V} t}$$

$t=0 \quad y=y_0$

$y_0 = c - G$
 $G = c - y_0$

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$$33. \quad \frac{dy}{dt} = 1 \cdot y(1-y) \quad y_0 = .1$$

$$\text{logistic} \quad k=1, \quad m=1$$

$$A = \frac{1-.1}{.1} = \frac{.9}{.1}$$

$$A=9$$

$$y = \frac{m}{1+A e^{-kmt}}$$

$$y = \frac{1}{1+9e^{-t}}$$

$$A = \frac{m-y_0}{y_0}$$

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37.

$$\frac{dL}{dx} = -kL$$

$$H = 18 \quad (\text{half-life})$$

$$\int \frac{dL}{L} = \int -k dx$$

$$\frac{L_0}{2} = L_0 e^{-k \cdot 18}$$

$$e^{\ln(L)} = e^{-kx + C}$$

$$\frac{1}{2} = e^{-18k}$$

$$L = e^{-kx} \cdot e^C$$

$$\frac{\ln \frac{1}{2}}{-18} = -k$$

$$L = L_0 e^{-kx}$$

$$\ln \frac{1}{2} = \ln 1 - \ln 2 = -\ln 2$$

$$\frac{-\ln 2}{-18} = k$$

$$k = \frac{\ln 2}{18}$$

$$18 = \frac{\ln 2}{k}$$

$$\frac{L_0}{10} = L_0 e^{-\frac{\ln 2}{18} x}$$

$$\frac{1}{10} = e^{-\frac{\ln 2}{18} x}$$

$$\ln \frac{1}{10} = -\frac{\ln 2}{18} x$$

$$\text{so } x = \frac{18 \ln \frac{1}{10}}{-\ln 2} = 18 \left(\frac{-\ln 10}{-\ln 2} \right) = \frac{18 \ln 10}{\ln 2}$$

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